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DEPARTMENT OF AGRICULTURE.

Reports on Diseases of Plants in Ceylon during 1928.

BRIT. MUS. (N.H.) BOTANY

July, 1929.

COLOMBO:
A. C. RICHARDS, ACTING GOVERNMENT PRINTER, CEYLON.
1929.

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NATURAL HISTORY
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REPORT OF THE MYCOLOGICAL DIVISION.

Staff.

W. Small, M.B.E., M.A., B.Sc., Ph.D., F.L.S. ..	Mycologist (Acting Director of Agriculture)
Malcolm Park, A.R.C.S.	Assistant Mycologist (Acting Mycologist)
J. C. Haigh, B.Sc., A.R.C.S., A.I.C.T.A. ..	Assistant Mycologist
L. S. Bertus	Assistant in Mycology
H. F. Davidson	do.

Dr. Small took up duty in the head office on October 15 and acted as Director of Agriculture from November 22. Mr. C. Ragunathan was transferred to the office of the Joint Registrar of Co-operative Societies on October 1 ; his place was taken by Mr. H. F. Davidson, who commenced duty on probation on October 15.

Advisory Work.

During the year 488 consignments of diseased material were received for examination and report. This number is 55 less than that of the preceding year. The decrease may be explained by the increasing number of specimens of diseased tea and rubber sent to the mycologists of the Tea Research Institute and the Rubber Research Scheme respectively. The number of specimens of lesser plantation crops and of village agricultural products was greater than hitherto, and the proportion of those to specimens of tea and rubber was greater. As an indication of increase of interest by the small holder this is gratifying and more time has been spent on investigation of the diseases of minor products. Certain consignments of diseased plants require careful investigation and on occasions visits have been made to estates and gardens in order to study diseases under field conditions and in order to give more readily advice for remedial and control measures ; such visiting has been done by all members of the staff. Special mention may be made of visits of investigation to coconut areas in Mannar, Negombo, Siyane Korale, Kurunegala, and the Southern Province, and to plantain areas in Tissamaharama, Rambukkana, and Colombo Districts.

The following is a list of the diseases which have been recorded for the first time in Ceylon during 1928 :—

Ananas sativus. Pineapple.
Rhizoctonia bataticola. Root disease.

Anona squamosa. Custard apple.
Ustulina zonata. Collar rot.

Areca catechu.
Rhizoctonia bataticola. Root disease.

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Buddleia sp.
Sclerotium Rolfsii. Collar rot.

Cajanus indicus. Pigeon pea.
Oidiopsis sp. Powdery mildew of leaves.

Citrus maxima var. *uvacarpa*. Grape fruit.
Sporotrichum Citri. Scab of fruit.

Crotalaria spp.
Rhizoctonia bataticola. Root disease.
Fomes lignosus. Root disease.

Desmodium heterocarpum.
Rhizoctonia bataticola. Root disease.
Corticium salmonicolor. Pink disease of stems.

Dolichos Hosei (*Vigna oligosperma*).
Uromyces sp. Rust on leaves.

Eucalyptus spp.
Rhizoctonia bataticola. Root disease.

Eucalyptus globulus. Blue gum.
Macrophoma sp. Stem disease of seedlings.

Gliricidia maculata.
Sphaerostilbe repens. Collar rot.

Hevea brasiliensis. Rubber.
Fomes lamaoensis. Stem disease.

Hibiscus tiliaceus.
Oidium sp. Mildew.

Ipomoea Batatas. Sweet potato.
Rhizoctonia bataticola. Charcoal rot of tubers.

Mucuna nivea. Velvet bean.
Sclerotium Rolfsii. Stem disease.

Nicotiana tabacum. Tobacco.
Rhizoctonia Solani. Stem disease.
Mosaic disease.

Oryza sativa. Rice.
Helminthosporium Oryzae. Leaf spot.

Pentas carnea.
Rhizoctonia Solani. Stem disease.

Persea gratissima. Avocado pear.
Rhizoctonia bataticola. Root disease.

Phaseolus vulgaris. Bean.
Macrophomina Phaseoli. Ashy stem blight.

Phaseolus vulgaris (var. *Rodriguez*). Rodriguez bean.
Macrophomina Phaseoli. Stem and pod disease.

Punica Granatum. Pomegranate.
Gloeosporium sp. Anthracnose of fruits.

In addition to the above the host range of the eelworm, *Heterodera radicicola*, has been extended to include *Hibiscus esculentus* (bandakka), *Basella alba* (spinach), *Buddleia* sp., and *Heliotropium peruvianum* in addition to the hosts already recorded.

General Observations.

Hevea.—Many inquiries regarding *Hevea* mildew (*Oidium Heveae*) have been received during the year and the disease continues to receive attention. The first outbreak on young foliage brought to the notice of this division was observed after a period of five weeks during which no rain had been recorded and it would appear that the heavy dews occurring during the early part of the year are sufficient to supply the humidity necessary for the growth and rapid development of the fungus. The disease is now regarded as serious in certain districts. At the Agricultural Conference in May it was suggested that the disease could be controlled by spraying during a period in which the fungus was quiescent. Practical difficulties have so far prevented the undertaking of extensive spraying programmes.

There has been no increase in the number of specimens of root disease during the year. Pink disease (*Corticium salmonicolor*) occurred on the renewing cortex of trees treated for brown bast. *Fomes lamaoensis* was recorded for the first time as the cause of a stem disease. *Phytophthora* diseases were less prevalent probably owing to climatic conditions. Rim blights of old leaves were reported periodically, but did not cause much damage.

Tea.—No new diseases of tea have been reported during the year. Most of the specimens received have consisted of examples of root diseases or of the common leaf spots. It would appear that modern methods of careful pruning, cultivation, and manuring tend to reduce the incidence of wood rot or branch canker. Diseases of seedlings due to eelworms, excess of water, *Rhizoctonia Solani*, and root disease have been recorded, but care in the choice of sites for nursery beds and their careful preparation minimize the risk of such outbreaks.

Coconut.—More interest has been taken in the diseases of coconuts. Examples of root disease, on which observations will be made below, bud rot, the physiological fall of immature nuts, *Ceratostomella* (*Thielaviopsis*) *paradoxa* on young stems, and grey blight (*Pestalozzia palmarum*) of leaves have been received. A long spell of wet weather at the end of the year provided conditions suitable for the spread of the last-named disease and several outbreaks were reported, but, taken on the whole, it would appear that the coconut, given conditions favourable for its development, is less susceptible to disease than other plants like tea and rubber which are also planted on a large scale.

Paddy.—*Sclerotium Oryzae* was found to cause considerable damage to young plants in nurseries planted under unfavourable conditions. Blast (*Piricularia Oryzae*) and leaf spots caused by *Helminthosporium Oryzae* have been reported on several occasions and some nursery plants were found to be affected with sun scorch.

Other Food Crops.—Bacterial wilt (*B. Solanacearum*) on solanaceous plants has caused considerable damage in village gardens where rotation is not practised and has assumed the rôle of a limiting factor for the growth of tomatoes and brinjals in certain areas. The prevalence of eelworm (*Heterodera radicicola*) is another factor which has assumed importance in the growth of truck crops. Mosaic diseases of brinjals and bandakka have been recorded during the year, the latter affecting over 50 per cent. of the plants in one group of village gardens in the Southern Province. Ashy stem blight of beans (*Macrophomina Phaseoli*) was reported on several occasions.

Green Manures, &c.—The dying out of Vigna (*Dolichos Hosei*) in patches caused by *Rhizoctonia Solani* has attracted considerable attention during the year as have the depradations caused by the Kalutara or African snail (*Achatina fulica*). Spraying experiments conducted by the mycologist of

the Rubber Research Scheme have indicated that satisfactory control of such attacks is possible. Rust (*Uromyces* sp.) has been recorded as attacking the leaves of Vigna, which observation was made simultaneously by the mycologist of the Rubber Research Scheme. Specimens of root disease of the woody green manures have been received from time to time, but there is no indication that any one of these plants is particularly susceptible to root disease. The die-back of dadap (*Erythrina lithosperma*) caused by *Fusarium* sp. has been reported, but generally in association with unfavourable weather conditions. A similar fungus has also caused a die-back of dadap seedlings.

Fruits.—Numerous inquiries have been received regarding citrus scab (*Pseudomonas Citri*) and orange mildew (*Oidium tingitaninum*), both of which have been very common and have caused considerable damage. Among other citrus diseases recorded during the year are *Rhizoctonia bataticola* root disease, pink disease (*Corticium salmonicolor*), and a collar rot of unknown origin. *Rhizoctonia bataticola* root disease has been recorded on avocado (*Persea gratissima*), plantain (*Musa paradisiaca*), and pineapple (*Ananas sativus*). An internal browning of pineapples, apparently of physiological origin, resulted in considerable loss of crop in certain gardens in the Southern Province. Among the fruit diseases reported were a rot of pineapples (*Ceratostomella paradoxa*) and anthracnose (*Gloeosporium* sp.) of pomegranate (*Punica Granatum*).

Miscellaneous.—Numerous other specimens of diseases previously recorded were received during the year among which were bacterial leaf disease and *Phytophthora* stem disease of betel, bacterial wilt, *Rhizoctonia bataticola* root disease, mosaic and eelworm disease of tobacco, sore shin, angular leaf spot and black arm of cotton, scabby bark (apparently physiological) of cinnamon, *Septogloeum arachidis* leaf spot of groundnut, and *Rhizoctonia bataticola* root disease of roses. Sixteen fructifications of larger fungi were identified and a considerable number of cultures of fungi and dried specimens was sent to and received from plant pathologists in other countries.

Major Investigations.

(*a*) *Rhizoctonia bataticola* and Root Disease.—Dr. Small continued his investigation into root diseases of economic crops. The host range of *Rhizoctonia bataticola* has been extended and the fungus has now been found on the roots of more than sixty Ceylon plants. The interest of other tropical workers has been aroused and the fungus has been found associated with root disease of woody plants in Java, Malaya, India, Western Australia, Iraq, Palestine, Nyasaland, Uganda, Southern Rhodesia and the British West Indies, from which it would appear that the fungus is common throughout the tropical zone. Dr. Small has carried out a number of inoculation experiments and his results indicate that *Rhizoctonia bataticola* is capable of killing tea and other seedlings. A preliminary inoculation experiment carried out on plantains demonstrated that it is possible that the occurrence of bunchy top is, to some extent at least, affected by the presence of root disease, and a large-scale experiment is being carried out by the Government Entomologist to determine whether a virus transmitted by aphids is the sole causal agent of the Ceylon form of the disease. The study of the morphological and cultural characters of *Rhizoctonia bataticola* has been continued in an endeavour to classify the various strains of the fungus that have been obtained. The forms fall into three main classes according to the size of sclerotia and certain other microscopic characters. These forms are distinct and it is interesting to note that more than one form may occur at one time on the same host plant. Mr. Haigh has continued the morphological investigation of sclerotia of

Rhizoctonia bataticola and has carried out numerous inoculation experiments to determine the connection between sclerotia of various strains and the pycnidial form, *Macrophomina Phaseoli*.

(*b*) *Mycorrhiza of Tea.*—The writer has continued observations into the occurrence of endotrophic mycorrhiza in tea. A number of healthy rootlets have been examined from five tea-growing districts at elevations ranging from sea level to 6,000 feet and in each sample it was found that nearly 100 per cent. of the healthy rootlets contained endotrophic mycorrhiza with typical arbuscles and vesicles. Isolation experiments from mycorrhizal rootlets at Peradeniya have given two fungi of the *Rhizoctonia* type regularly and one of these is similar to certain strains of *Rhizoctonia bataticola*. The isolation experiments are being extended and it is proposed to treat healthy roots from various elevations similarly. Observations already made are of interest and may throw light on the relationship of *Rhizoctonia bataticola* to root disease.

In conjunction with these experiments, tea seedlings have been reared under sterile conditions in sand culture and water culture experiments are in progress in an endeavour to demonstrate the significance of the mycorrhiza. It would appear from results obtained so far that the symbiosis is not obligatory and it remains to be seen whether the presence of endotrophic mycorrhiza is or is not beneficial to tea. Dr. Small and Mr. Ragunathan continued observations on the presence of *Rhizoctonia bataticola* in apparently healthy woody roots and it has been shown that a large number of apparently healthy roots of tea, rubber and coconut when surface-sterilized and kept in a damp chamber develop sclerotia of *Rhizoctonia bataticola* after a few weeks.

(*c*) *Paddy.*—Mr. Bertus has continued investigations into the sclerotial diseases of paddy. The second form of *Sclerotium* obtained from diseased plants in Ceylon has been compared with and has proved to be different from *Sclerotium Oryzae-sativae* Saw. and is regarded as a non-chromogenic strain of *Sclerotium Oryzae*. A series of inoculation experiments on paddy seedlings carried out in the laboratory has demonstrated that both *Sclerotium Oryzae* and the non-chromogenic strain can infect both roots and stems under favourable conditions, while the *Rhizoctonia Solani* strains can infect stems only. From observations made in the field it would appear that, given conditions unfavourable to the host, *Sclerotium Oryzae* is capable of causing considerable damage in paddy nurseries.

(*d*) *Coconut.*—Work on coconut root disease has been continued during the year. In a paper read at the Agricultural Conference held at Peradeniya in May, it was pointed out that symptoms similar to those exhibited by palms affected with root disease may be caused by a variety of unfavourable conditions and that authentic cases of root disease caused by fungi are less common than is generally supposed. A number of palms with suspected root disease have been examined during the year and isolations from diseased tissue have been made. A series of inoculation experiments on mature palms at Peradeniya has been set up and there are indications that positive results may be obtained.

Minor Investigations.

Observations were made on the incidence and extent of *Oidium* mildew on rubber. A stem disease of *Hevea* caused by *Fomes lamaoensis* was investigated and notes were published in the *Tropical Agriculturist* for April. Mr. Haigh has examined samples of *Hevea* bark for determination of the number of rows of latex vessels. Mr. Bertus investigated a seedling disease of dadap (*Erythrina lithosperma*) caused by *Fusarium* sp., a disease of velvet bean (*Mucuna nivea*) caused by *Sclerotium Rolfsii* and a stem disease of *Pentas carnea* caused by *Rhizoctonia Solani*.

Miscellanea.

Mr. Haigh has been in charge of the departmental library during reorganization and is undertaking the compilation of cross-reference subject and author catalogues. Specimens have been added to the herbarium and the card indices of current literature and mycological records have been brought up to date. Mr. Bertus has taken photographs for officers of the various divisions of the Department and has given a course of lectures on plant diseases to second-year students at the Farm School, Peradeniya.

Publications.

The following papers and shorter notes have appeared or have been sent to the press during 1928 :—

W. Small : On *Rhizoctonia bataticola* (Taub.) Butler as a cause of root disease in the tropics. *Transactions of the British Mycological Society* 13, p. 40, 1928.

Further notes on *Rhizoctonia bataticola*. Mycological Notes (13) and (14), *Tropical Agriculturist*, 70, p. 227, April, 1928 ; 71, p. 77, August, 1928.

The parasitism of *Rhizoctonia bataticola* (Taub.) Butler and other fungi. Mycological Notes (16), *Tropical Agriculturist*, 71, p. 215, October, 1928.

Bunchy-top disease of plantains in Ceylon. Mycological Notes (15), *Tropical Agriculturist*, 71, p. 141, September, 1928.

A note on the parasitism of *Macrophomina Phaseoli* (Maubl.) Ashby (*Rhizoctonia bataticola* (Taub.) Butler. Mycological Notes, *Tropical Agriculture* (Trinidad) 5, p. 315, December, 1928.

W. Small and L. S. Bertus : On the parasitism of *Sphaerostilbe repens* B. and Br. (in the press).

W. Small and C. Ragunathan : Die-back of woody plants in the tropics with special reference to *Botryodiplodia Theobromae* Pat. and root disease (in the press).

M. Park : A preliminary note on a mycorrhizal fungus of tea roots. Mycological Notes (11), *Tropical Agriculturist*, 70, p. 171, March, 1928.

Hevea stem disease caused by *Fomes lamaoensis*. Mycological Notes (12), *Tropical Agriculturist* 70, p. 225, April, 1928.

Investigation of root diseases of coconuts. *Tropical Agriculturist* 70, p. 402, June, 1928.

J. C. Haigh : *Macrophomina Phaseoli* (Maubl.) Ashby, the pycnidial stage of *Rhizoctonia bataticola* (Taub.) Butler. Mycological Notes (9), *Tropical Agriculturist* 70, p. 77, February, 1928.

Report on a bark examination of Peradeniya and Henaratgoda rubber trees. *Ceylon Journal of Science* (*Annals of the Royal Botanic Gardens, Peradeniya*) 11, part 1, p. 63, May, 1928.

L. S. Bertus : A die-back of tea seedlings. Mycological Notes (10), *Tropical Agriculturist* 70, p. 80, February, 1928.

Sclerotium Rolfsii Sacc. in Ceylon (in the press).

C. Ragunathan : Bacterial leaf spot of betel. *Ceylon Journal of Science* (*Annals of the Royal Botanic Gardens, Peradeniya*) 11, part 1, p. 51, May, 1928.

Department of Agriculture, Ceylon, Bulletin No. 83, a list of the fungi associated with diseases of cultivated plants in Ceylon, compiled by the Division of Mycology, was published in June.

January 18. 1929.

MALCOLM PARK,
Acting Mycologist.

The following reports from the Plant Pest Inspectors indicate the occurrence of diseases in the several divisions during the year.

CENTRAL DIVISION.

The Central Division comprises the Central Province and the Kegalla District of the Province of Sabaragamuwa, and also the Ratnapura District of the Province of Sabaragamuwa and the Badulla District of the Province of Uva for tea tortrix and tea nursery inspections.

Staff.

N. K. Jardine	..	Inspector
J. Jackson Smale	..	Sub-Inspector
W. P. de Silva	..	do.
A. W. Kannangara	..	do.
J. A. B. Mackelvie	..	do.

Diseases.

Bud Rot of Coconut has not been in great evidence during the year ; immediate and complete destruction of the crown was carried out in every case.

Soft Rot of Betel has not been so prevalent as in the previous year. Records show that the disease has been moderate throughout the period under review.

Water Hyacinth (*Eichhornia crassipes*).—The few areas wherein this weed appears are small, and control is normally easy.

SOUTHERN DIVISION.

Staff.

W. R. C. Paul, B.A., M.Sc., D.I.C., F.L.S., Dip. Agric. (Cantab.)	.. ..	Acting Inspector
M. S. Mendis, Dip. Agric. (Poona)	..	Sub-Inspector
B. A. Pereira	.. ..	do.
Joubert de Zilva	.. ..	do.

Diseases.

Paddy.—Blast (*Piricularia Oryzae*) occurred very slightly, but *Helminthosporium* sp. was found severe on several fields in the Kalutara District. A small amount of *Sclerotium Oryzae* was noted on a few plants in a certain field which had also a severe attack of *Helminthosporium*. It is of interest to note that *Sclerotium Oryzae*, which in the previous year was conspicuous on certain fields in the Kalutara and Matara Districts, was not found on these fields during the present year.

Coconuts.—A few cases of stem bleeding disease (*Ceratostomella* (*Thielaviopsis*) *paradoxa*) were observed, but the progress of the disease was slow and the fungus did not prove very active in culture.

Rubber.—Branch canker and brown bast are still present in many areas. An interesting record of *Xylaria Thwaitesii* on roots showed the fungus to contain fully mature perithecia and spores. Root disease revealing the presence of *Rhizoctonia bataticola* amongst the common root fungi was reported in a few instances.

Tea.—Prolific callus growth in the stems as a result of attack by *Macrophoma theicola*, a cause of branch canker, was noted from several areas. Die-back of stems has also been observed as common. Prevalent leaf diseases are the grey and brown blights and scabbing.

Plantains.—There is a notable decrease in the presence of bunchy-top in the division. It has not yet been recorded from Tissa, where another disease, as yet unidentified and associated with water soaked areas of the pseudo-stem and leaf stem, has caused much damage.

Cotton.—Leaf mildew (*Ramularia areola*) and angular leaf spot (*? Phytomonas Malvacearum*) are of general occurrence, but of no great importance.

Citrus.—Die-back associated with *Rhizoctonia bataticola* on the roots is common on orange and lime trees, which are gradually dying out in many areas.

Albizzia.—The gumming disease of *Albizzia moluccana* trees, in which *Nectria pulcherrima* has been found present, is still causing much damage to this shade tree in the Galle District.

Two new records of eelworm disease (*Heterodera radicicola*) in Ceylon were made on bandakka (*Hibiscus esculentus*) and spinach (*Basella rubra*) (Singh. *Nivitti*).

Bacterial wilt of radishes (*Raphanus sativus*) and brinjals (*Solanum melongena*) was noted in several areas.

The following virus diseases have been observed for the first time : leaf-curl and crinkle of brinjal and chillies, leaf mosaic of bandakka, leaf mosaic of betel, and spike disease of citronella. The disease of bandakka has been particularly common.

The following are the recorded hosts of *Rhizoctonia bataticola* in the division : tea, rubber, bandakka, dhall, chilli, Rodriguez bean (*Phaseolus lunatus* var.), sunflower (*Helianthus annuus*), and pineapple, the last three being reported for the first time in Ceylon. The pycnidial stage (*Macrophomina Phaseoli*) was recorded for the first time in Ceylon from the Rodriguez bean and sunflower hosts.

NORTH-WESTERN DIVISION.

Staff.

C. N. E. J. de Mel, B.Sc., M.S.E.A.C.	..	Plant Pest Inspector
M. R. M. Jebaratnam ..	..	Sub-Inspector
T. J. Jayaratnam ..	..	do.
L. D. C. M. Fernando ..	..	do.
D. B. de Silva ..	..	do.

Diseases.

Coconuts.—Bud rot and stem bleeding disease have occurred more than in previous years. The increase in the former is confined to the Giriulla district. Stem bleeding disease has done much damage on young palms with sappy immature wood. *Rhizoctonia bataticola* has been recorded on roots of coconuts and is considered by the Mycologist to be a cause of disease of the coconut tree. Field investigations appear to show that true disease of roots occurs, but is not common. Grey blight is very common and has proved specially harmful to young palms on sandy and gravelly soils.

Rubber.—Brown bast is the most important disease, while *Ustulina*, brown root (*Fomes lamaoensis*), and white root (*Fomes lignosus*) have been recorded. *Rhizoctonia bataticola* occurs in conjunction with *Fomes*.

Paddy.—No damage by disease was noted. *Betel vines* suffered much in several villages from bacterial leaf spot.

Tobacco suffers more from insect pests than disease, although eelworm does damage in some areas.

RECORD OF DISEASES.

Host.	Disease.	Remarks.
Coconut ..	Bud rot (*Phytophthora* sp.) ..	Slight increase
	Stem bleeding disease (*Thielaviopsis Paradoxa*)	Increase
	Rhizoctonia bataticola	
	Grey blight (*Pestalozzia palmarum*)	
Rubber ..	*Rhizoctonia bataticola* ..	—
	Dry root and collar rot (*Ustulina zonata*)	
	Brown root (*Fomes lamaoensis*)	
	White root (*Fomes lignosus*)	
	Brown bast	
	Diplodia	
	Black thread (*Phytophthora* sp.)	
	Canker (*Phytophthora* sp.)	
Tea ..	*Diplodia*	—
	Ustulina zonata	
Paddy ..	*Piricularia Oryzae*	Negligible
Plantains ..	Bunchy top	Decreasing
Tobacco ..	Leaf spotting fungus (*Cercospora Nicotianae*)	Common
	Eelworm (*Heterodera radicicola*)	
	Little leaf	
	Mosaic disease	
Betel ..	Bacterial leaf spot	—
Grape vine ..	*Plasmopora viticola*	—
Jak ..	*Fomes rimosus*	Often seen on old trees
Brinjal ..	*Bacillus Solanacearum* ..	—

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